1st 2011 International Conference

WASTES solutions treatments opportunities

SYNTHESIS OF ALUMINA BASED ON INDUSTRIAL WASTE MATERIAL

S. López-Andrés(1), L. Fillali(2), J.A. Jiménez(2), H. Tayibi(2), I. Padilla(2) and A. López-Delgado(2)

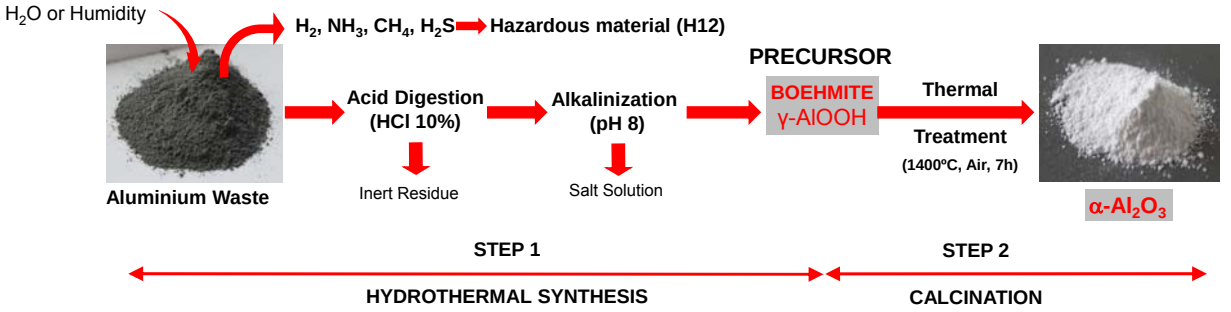
(1) Dpt. Crystallography and Mineralogy, Faculty of Geology, UCM. 28040 Madrid, Spain.
(2) National Centre for Metallurgical Research, CSIC. Avda. Gregorio del Amo, 8. 28040 Madrid, Spain. alopezdelgado@cenim.csic.es

INTRODUCTION

Nowadays environmental policies of industrialized countries aim not only to eliminate or reduce waste generation, but seek to save natural resources through the secondary resources management. This strategy is promoted by the Directive of the European Parliament and of the Council on Waste.

In this work, a hazardous waste obtained by the tertiary aluminium industry, was used as aluminous raw material for the synthesis of alumina. Polymorphic aluminium oxides (Al_2O_3) are extensively used in numerous industrial applications (ceramics, abrasive materials, absorbents, catalysts, biomaterials, composites, pigments, etc). This means working to transform an hazardous waste on a added- value material.

EXPERIMENTAL



CARACTERIZATION

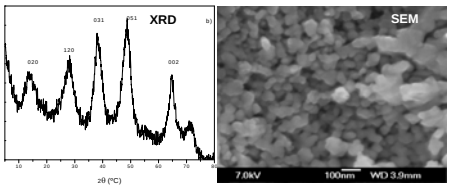
- XRF
- XRD
- TG/DTA
- SEM/TEM

CHARACTERIZATION

ALUMINIUM WASTE

Chemical Composition [%]	
31.2	Al metal
20.0	Al_2O_3
15.0	$MgAl_2O_4$
8.4	AlN
8.0	SiO_2
8.2	$CaCO_3$
1.8	Fe_2O_3
1.5	TiO_2
1.5	Cl
0.7	Al_2S_3
Other minor oxides	

PRECURSOR (BOEHMITE)

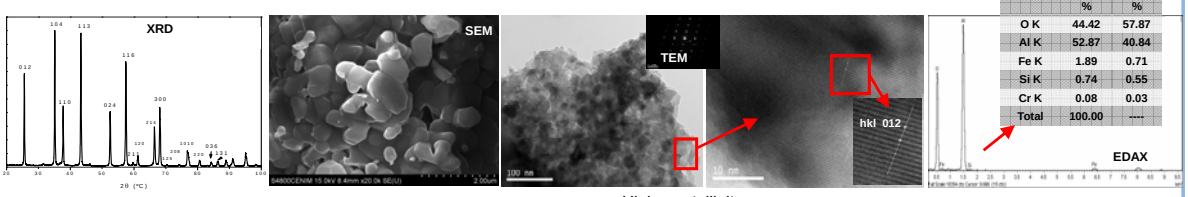


Boehmite (JCPDS 1-088-2112)

Grain Size <100 nm
Low crystallinity

Compound	Boehmite [%]	Alumina [%]
Al_2O_3	61.53	94.91
Fe_2O_3	2.05	3.31
SiO_2	0.64	0.94
ZnO	0.33	0.38
CuO	0.11	0.09
Cr_2O_3	0.09	0.07
PbO	0.03	0.07
Cl	3.20	----

ALUMINA



Element	Weight %	Atomic %
O K	44.42	57.87
Al K	52.87	40.84
Fe K	1.89	0.71
Si K	0.74	0.55
Cr K	0.08	0.03
Total	100.00	----

α-Al_2O_3 (JCPDS 1-089-7717)

High crystallinity

CONCLUSION

- A hazardous waste can be used as raw material for other industries to contribute to the reduction of natural resources.
- The process developed allows to obtaining 1t of nanometric sized corundum particles with an aluminium oxide content of 95% from 4t of hazardous waste.
- The morphological and crystallographic characteristic α-Al_2O_3 would allow its use for the ceramic industry.
- The inert solid residue generated consisting principally of spinel, corundum and quartz with possible uses in cements or glass industry.

REFERENCES

- Directive 2008/98/EC of the European Parliament and of the Council on Waste and Repealing Ceertain Directives, 2008.
- A. López-Delgado, H. Tayibi. Can hazardous waste become a raw material?. The case study of an aluminium residue: a review. Waste Manage. Res. In press (2011).
- L. Gonzalo-Delgado, A. López-Delgado, F.A. López, F.J. Alguacil and S. López-Andrés, Recycling of hazardous waste from tertiary aluminium industry in a value-added material. Waste Manage and Res. 29(2) (2011) 127-134.

*The authors thank the MEC for financing project CTM2005-01964 and the company Recuperaciones y Reciclajes Roman S.L. (Fuenlabrada, Madrid, Spain) for supplying the waste.

GOBIERNO DE ESPAÑA · MINISTERIO DE CIENCIA E INNOVACIÓN · CSIC Consejo Superior de Investigaciones Científicas · CENTRO NACIONAL DE INVESTIGACIONES METALÚRGICAS · UNIVERSIDAD COMPLUTENSE MADRID